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**Patent and Trademark Office**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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EXAMINER  
PAREKH, N

ART UNIT PAPER NUMBER  
2811

DATE MAILED: 10/19/01

**Please find below and/or attached an Office communication concerning this application or proceeding.**

**Commissioner of Patents and Trademarks**

# Office Action Summary

Application No.

09/517,345

Applicant(s)

Anderson et al

Examiner

Nitin Parekh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on Apr 12, 2001
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 35 C.D. 11; 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-25 and 49-61 is/are pending in the application.
- 4a) Of the above, claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-25 and 49-61 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claims \_\_\_\_\_ are subject to restriction and/or election requirements.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some\* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

## Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892)
- 16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2 and 12
- 18) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other: \_\_\_\_\_

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## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

2. Claims 49-59 and 61 are rejected under 35 U.S.C. 102(a) as being anticipated by Schueller (US Pat. 5866949).

Regarding claims 49-54, 56-59 and 61, Schueller discloses an integrated circuit (IC)/Ball Grid Array (BGA) package comprising a single or multiple IC dice:

- an IC die (52 in Fig. 3A) having a front side, backside and a first thickness between the front and back sides, where the bonding pads (Col. 8, line 25) are formed on the front side
- a metallized polymer layer/tape (58/59/60 in Fig. 3A) having a first side and a second side wherein the bonding pads are electrically coupled to the features/patterns (59 in Fig. 3A) of the metallized polymer layer/tape using bonding wires (82A in Fig. 3A)
- a transition medium/support structure between the IC die and the metallized polymer layer (50A in Fig. 3A) having only an adhesive layer (64A in Fig. 3A) between the two where the transition medium/support structure has a second thickness less than the first thickness, the

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second thickness being relatively uniform and none of the bonding pads being electrically coupled to the transition medium

- the backside of the IC die faces toward the transition medium and the front side of the IC die faces away from the metallized polymer layer/tape

- the IC die, metallized polymer layer/tape and transition medium are parallel planes, and

- solder balls (54 in Fig. 3A) below the metallized polymer layer/tape and the IC die electrically coupled to the bonding pads

(Fig. 3A; Col. 8, line 24; Col. 7, line 3- Col.1, line 12).

Regarding claim 55, Schueller further discloses using the transition medium/support comprising a single or multilayered structure including non-polymer material, ceramic or a combination of metal and non-metal/epoxy PCB material (Col. 9, line 58; Col. 10, line 27; Col. 11, line 12).

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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4. Claim 60 is rejected under 35 U.S.C. 103(a) as being unpatentable over the prior art (IDS reference, Schueller-US Pat. 5866949) in view of Solberg (US Pat. 6054337) and the admitted prior art (APA).

The combined teachings of the prior art (Schueller), Solberg and APA apply to Claim 60 as explained above for claims 49, 1 and 5.

5. Claims 1-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over the prior art (IDS reference, Schueller-US Pat. 5866949) in view of Solberg (US Pat. 6054337).

Regarding claims 1 and 18, the cited prior art discloses an integrated circuit (IC)/BGA package comprising:

- a silicon die (52 in Fig. 3B/3A) having a first thickness
- a metallized polymer layer (58/59/60 in Fig. 3B/3A) having a first side and a second side, and
- a transition medium/support structure (50 in Fig. 3B/3A) disposed between the silicon die and the first side of the metallized polymer layer where the transition medium/support structure has a second thickness

(Fig. 3B/3A; Col. 8, line 12- Col. 10, line 36; Col. 5, line 36- Col. 6, line 55).

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The prior art fails to specify the first thickness of the silicon die being less than the second thickness. Solberg teaches using a silicon die with a smaller thickness than that of a transition medium/compliant element in a tape carrier/IC package (Fig. 10; Fig. 6-10; Col. 9, line 35- Col. 10, line 60). Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the first thickness of the silicon die with a smaller thickness than the second thickness of transition medium to reduce the thermal stress using Solberg's design in the prior art.

Regarding claim 2, the prior art discloses the transition medium/support structure comprising a single or multilayered structure including conventional conductive/non-conductive material such as ceramic, metal, PCB or a combination of metal and non-metal/epoxy PCB material (Col. 9, line 58; Col. 10, line 27; Col. 11, line 12).

Regarding claims 3 and 11, the prior art discloses encapsulating the silicon die and the transition medium with a conventional plastic encapsulant/mold cap, the die being disposed near the middle of the package (Col. 8, line 40; Fig. 3B). The conventional encapsulant and adhesives have thermal coefficient of expansion (TCE) range of  $7-15 \times 10^{-6}/^{\circ}\text{C}$  and approximately  $58 \times 10^{-6}/^{\circ}\text{C}$  respectively (Table 2- admitted prior art). Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate a plastic

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encapsulant having approximate TCE range of  $7-17 \times 10^{-6}/^{\circ}\text{C}$  to reduce the thermal stress in the prior art in view of Solberg.

Regarding claims 4 and 5, the prior art discloses the transition medium/support structure used to reduce the thermal stress/ cracks and to improve the reliability and of conventional nonconductive epoxy/PCB type material (Col. 10, line 18-27) but fails to specify the range of TCE of the material. The prior art further discloses conventional BGA packages using elastomers and adhesives as a transition medium (Fig. 2; Col. 5 and 6) to reduce the thermal stress. It is conventional in chip packaging art to use such nonconductive material/packaging substrates as epoxy, molded plastic, FR-4/5, BT resin, etc. which have typical TCE in the range of  $10-17 \times 10^{-6}/^{\circ}\text{C}$  (see admitted prior art-Table 2). Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the transition medium comprising molded compound, FR-4/5, or BT resin compound and having the TCE range of  $7-17 \times 10^{-6}/^{\circ}\text{C}$  to reduce the thermal stress in the prior art in view of Solberg.

Claim 6 is rejected as explained above for claims 4 and 5.

Claim 7 is rejected as explained above for claims 1 and 3.

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Regarding claims 8, 9, 16 and 17, as explained above for claim 1, the prior art fails to specify the dimensions such as the thickness of the package and die or the cross-sectional area of the die being larger than that of the transition medium. However, in the chip packaging art, such parameters as the package/die thickness, area, area ratio of various components, volume, weight, etc. are considered to be a matter of design choice and are selected to meet device performance and reliability requirements. Therefore, it would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the thickness of the package and the die to be less than approximately 0.060 inches and 6 mils respectively and the area of the die being less than, equal or larger than that of the transition medium to meet the design requirements in the prior art in view of Solberg.

Regarding claim 10, the prior art discloses coupling of the silicon die to the transition medium using an adhesive (Fig. 3B; Layer 64).

Regarding claims 12-15, the prior art discloses a tape carrier having a dielectric and conductive layers as IC metallized polymer layer and solder balls mounted to the second side of the metallized polymer layer, the solder balls electrically contacting the etched circuit in a conductive layer of the tape carrier and arranged in a grid fashion under the position of the die and connecting the package to a PCB (Fig. 3B; Col. 7, lines 32 and 58; Col. 5-12; Fig. 6).



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Claim 19 is rejected as explained above for claims 8, 9, 16 and 17.

6. Claims 20-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over the prior art (IDS reference, Schueller-US Pat. 5866949) in view of Solberg (US Pat. 6054337).

The combined teachings of the prior art (Schueller) and Solberg apply to Claim 20 as explained above for claims 1 and 3.

The combined teachings of the prior art (Schueller) and Solberg apply to Claims 21-25 as explained above for claims 20, 1;5, 10, 4 and 12 respectively.

7. Claims 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over the prior art (IDS reference, Schueller-US Pat. 5866949) in view of Solberg (US Pat. 6054337).

Regarding claim 25, as explained above from the combined teachings of the prior art (Schueller) and Solberg for claims 1-19 and 20-24, the prior art further discloses using the first and second adhesive layers having respective TCE disposed on the tape carrier and the transition medium respectively (Fig. 3B; Col. 9, line 65; Col. 8, line 12- Col. 10, line 36).

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*Response to Arguments*

8. Applicant's arguments filed on 04-12-01 have been fully considered but they are not persuasive.

A. Applicant contends that Schueller in view of Solberg do not teach using the thickness of the silicon die being less than the thickness of the transition medium. However, as explained above for claim 1, Schueller discloses using a transition medium/support structure disposed between the silicon die and the first side of the metallized polymer layer where the transition medium/support structure can be selected to include a single layer, multilayered/laminated structure comprising an epoxy PCB material, ceramic or metal to provide the desired thickness/rigidity and stress reduction (Fig. 3B; Col. 9, line 55- Col. 10, line 27). Furthermore, Solberg teaches using a silicon die with a smaller thickness than that of a transition medium/compliant element (58, 59, 61, etc. in Fig. 3 and 4; 371 in Fig. 10) in a variety of tape carrier/IC package configurations (Col. 8, line 35- Col. 9, line 17; Col. 9 and 10). Therefore, Solberg's structure/design related to the thickness of the transition medium and that of the silicon die is applied to Schueller's package to achieve the desired package design requirements.

9.

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*Conclusion*

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Papers related to this application may be submitted directly to Art Unit 2811 by Facsimile transmission. Papers should be faxed to Art Unit via Tech Center 2800 fax center located in Crystal Plaza 4, Room 4C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (15 November 1989).

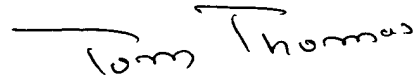
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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nitin Parekh at (703) 305-3410. The examiner can normally be reached on Monday-Friday from 08:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas, can be reached on (703) 308-2772. The fax number for the organization where this application or proceeding is assigned is (703) 308-7722 or 7724.

Nitin Parekh

10-10-01



**TOM THOMAS**  
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